03-01-01 518 Rec'd PCT/PTO 31 JUL 20

FORM PTO-1390 (Modified) (REV 10-95) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: P-6250

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR): 09/890546

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/FR00/00266	04 February 2000	04 February 1999

TITLE OF INVENTION
RADIO STATION ANTENNA WITH CIRCULAR POLARISATION

JUL 31 2001 PATENT & TRADEMARK OFFICE

APPLICANT(S) FOR DO/EO/US
Thierry LUCIDARME

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 18 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
    A **SECOND** or **SUBSEQUENT** preliminary amendment.
16. ☐ A substitute specification.
17. ☐ A change of power of attorney and/or address letter.
18. ☒ Certificate of Mailing by Express Mail
19. ☒ Other items or information:

PCT Request Form PCT/RO/101 (3 pgs.)
2 Sheets of Formal Drawings
Return Receipt Postcard

JC05 Rec'd PCT/PTO 31 JUL 2001

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/890546	PCT/FR00/00266	P-6250

20. The following fees are submitted:.

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :		CALCULATIONS PTO USE ONLY
☒ Search Report has been prepared by the EPO or JPO	$860.00	
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482)	$720.00	
☐ No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2))	$790.00	
☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO	$1,070.00	
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)	$98.00	

ENTER APPROPRIATE BASIC FEE AMOUNT =				$860.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).				$0.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	8 - 20 =	0	x $18.00	$0.00	
Independent claims	1 - 3 =	0	x $80.00	$0.00	
Multiple Dependent Claims **(check if applicable)**.			☐	$0.00	
TOTAL OF ABOVE CALCULATIONS =				$860.00	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) **(check if applicable).**			☒	$0.00	
SUBTOTAL =				$860.00	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).			+	$0.00	
TOTAL NATIONAL FEE =				$860.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).**			☒	$0.00	
TOTAL FEES ENCLOSED =				$860.00	
				Amount to be refunded	$
				charged	$

☒ A check in the amount of **$860.00** to cover the above fees is enclosed.

☐ Please charge my Deposit Account No. in the amount of to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **18-2284** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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Michael L. Kenaga
SIGNATURE

Michael L. Kenaga
NAME

34,639
REGISTRATION NUMBER

July 31, 2001
DATE

09/890546
JC05 Rec'd PCT/PTO 31 JUL 2001

ATTORNEY DOCKET: P6250

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Lucidarme)
)
Serial No.: Unassigned)
)
Filed:)
)
For: RADIO STATION WITH)
CIRCULATORY POLARIZED)
ANTENNA)
)
Examiner: Unassigned)
)
Group Art Unit: Unassigned)

"Express Mail" mailng label number EL843427837US

Date of Deposit July 31, 2001

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR § 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Stephanie Warner-Wallace
(Typed or printed name of person mailing paper or fee)

Stephanie Warner-Wallace
(Signature of person mailing paper or fee)

COMMISSIONER OF PATENT AND TRADEMARKS
WASHINGTON, D.C. 20231

PRELIMINARY AMENDMENT

Dear Sir:

Prior to examination, please amend the above identified application as follows:

IN THE SPECIFICATION:

Page 1, between lines 1 and 2, insert the heading -- BACKGROUND OF THE INVENTION --.

Page 1, line 7, replace the term "colors" by -- couplers --.

Page 1, line 31, insert -- and -- after the term "antenna".

Page 2, between lines 6 and 7, insert the heading -- SUMMARY OF THE INVENTION--.

Page 3, before line 17, insert the heading -- BRIEF DESCRIPTION OF THE DRAWINGS --.

Page 3, between lines 37 and 38, insert the heading -- DESCRIPTION OF PREFERRED EMBODIMENTS --.

IN THE ABSTRACT:

Please cancel the abstract as printed in the front page of the PCT publication, and insert the Abstract of the Disclosure as submitted in the appended sheet.

IN THE CLAIMS:

Please cancel Claims 1-8 and add new claims 9-16 as follows:

9. (New) Radio station, comprising several antennas associated with hybrid polarizing couplers, respectively, each polarizing coupler having at least one input connected to radio signal processing means comprising at least one receiver and two outputs connected to the antenna which is associated therewith such that when said outputs deliver two quadrature radio signals, respectively, in response to a transmission signal received on one of the two inputs of the polarizing coupler, the

antenna which is associated therewith generates two orthogonal electric field components forming a circularly polarized wave, wherein the receiver is arranged so as to combine several input radio signals obtained from respective inputs of the hybrid polarizing couplers and wherein the antennas are placed so as to radiate toward diametrically opposite sectors.

10. (New) Radio station according to claim 9, wherein at least one of the hybrid polarizing couplers has two inputs, from which two input radio signals supplied to the receiver are respectively obtained and wherein the receiver is arranged so as to provide diversity processing based on said input radio signals.

11. (New) Radio station according to claim 9, comprising two receivers each receiving two input radio signals respectively, a first division means connected between an input of one of the hybrid polarizing couplers and first respective inputs of the two receivers, and a second division means connected between an input of another hybrid polarizing coupler and second respective inputs of the two receivers.

12. (New) Radio station according to claim 11, comprising two other receivers each receiving two input radio signals respectively, one of these two signals being supplied by the first division means and the other of these two signals being supplied by the second division means.

13. (New) Radio station according to claim 9, comprising at least one radio signal source delivering said transmission signal to an input of a polarizing coupler.

14. (New) Radio station according to claim 13, comprising at least one duplexer connected between the input of the polarizing coupler to which said transmission signal is delivered, an input of the receiver and the radio signal source.

15. (New) Radio station according to claim 14, wherein the radio processing means and the duplexer are housed in a main housing of the radio station, each antenna and each hybrid polarizing coupler being outside said main housing.

16. (New) Radio station according to claim 15, wherein the duplexer is included in a radio circuit also including part of the radio processing means.

Applicant: Lucidarme
Serial No.: __/___,___

REMARKS

Applicant has cancelled claims 1-8 and has added new claims 9-16. The new claims are identical to the cancelled claims, with the exception that the new claims have been amended to omit reference numerals and to otherwise conform the claims to U.S. patent practice.

The applicant respectfully requests the Examiner to find the new claims allowable.

Respectfully submitted,

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ABSTRACT OF THE DISCL0SURE

The radio station comprises several antennas associated with hybrid polarizing couplers. Each polarizing coupler has at least one input connected to radio signal processor comprising at least one receiver and two outputs connected to the antenna which is associated therewith. When said outputs deliver two quadrature radio signals in response to a transmission signal received on one of the two inputs of the polarizing coupler, the antenna which is associated therewith generates two orthogonal electric field components forming a circularly polarized wave. The receiver is arranged so as to combine several input radio signals obtained from respective inputs of the hybrid polarizing couplers and the antennas are placed so as to radiate toward diametrically opposite sectors.

RADIO STATION WITH CIRCULARLY POLARIZED ANTENNA

The present invention relates to a radio station, which can be used especially as a base station in cellular radiotelephony systems.

More particularly, the invention relates to a radio station, comprising several antennas associated with hybrid polarizing colors, respectively, each polarizing coupler having at least one input connected to radio signal processing means comprising at least one receiver and two outputs connected to the antenna which is associated therewith such that when said outputs deliver two quadrature radio signals, respectively, in response to a transmission signal received on one of the two inputs of the polarizing coupler, the antenna which is associated therewith generates two orthogonal electric field components forming a circularly polarized wave.

Document FR 2 746 991 discloses an arrangement of antennas in a radio station, the antennas transmitting a circularly polarized field. On reception, the waves picked up in order to produce the processed signals are linearly polarized. The receiver provides spatial diversity processing and linear polarization diversity processing in order to counteract channel fading.

In order to separate the transmitting and receiving paths, the antennas of the radiocommunication stations are associated with duplexers. In the case of circularly polarized antennas of the type described in FR 2 746 991, these duplexers are connected between the antenna the polarizing coupler.

Documents EP 0 449 492 and "Base Station/Vehicular Antenna Design Techniques Employed in High-Capacity Land Mobile Communications System" (Y. Yamada et al, Review of the Electrical Communications Laboratories, Vol. 35, No. 2, 1st March 1987, pages 115-121), WO 96/28944 and WO 97/37441,

disclose a base station comprising antennas which are distributed in a defined geometric configuration so as to transmit a circularly polarized field.

In addition, document WO 96/28944 and WO 97/37441 disclose receiving means which are intended to provide circular polarization diversity processing.

The aim of the present invention is, in particular, to propose other arrangements of antennas in radio stations, so as to obtain high performance in reception and/or to simplify its design and its construction.

To this end, in a radio station of the type indicated in the introduction, the receiver is arranged so as to combine several input radio signals obtained from respective inputs of the hybrid polarizing couplers, and the antennas are placed so as to radiate toward diametrically opposite sectors.

By virtue of this simple station design, the receiver processes several signals picked up on diametrically opposite sectors, these signals being obtained by mixing, in the hybrid couplers, different components of the electric field picked up by the antenna. The result of this is some smoothing of the perturbations which can affect these components, and therefore less sensitivity of the receiver to these perturbations.

Preferably, at least one of the hybrid polarizing couplers has two inputs, from which two input radio signals supplied to the receiver are respectively obtained, the receiver then being arranged so as to provide diversity processing based on said input radio signals. In this way, another form of polarization diversity is obtained in reception. Advantageously, this version makes it possible to counteract the fading effects, especially when the propagation medium creates relatively little diversity.

Where one or more duplexers are required, each of them can be connected between an input of the polarizing coupler, an input of the receiver and the

radio signal source. This gives greater flexibility in the design and the choice of antennas. In particular, the duplexer can be placed in the main housing of the radio station rather than with the antenna outside.

In particular embodiments:

- the radio station comprises two other receivers each receiving two input radio signals respectively, a first division means connected between an input of one of the hybrid polarizing couplers and first respective inputs of the two receivers, and a second division means connected between an input of another hybrid polarizing coupler and second respective inputs of the two receivers;

- the radio station comprises at least one radio signal source delivering said transmission signal to an input of a polarizing coupler.

Other particular features and advantages of the present invention will appear in the description below of nonlimiting embodiments, with reference to the appended drawings, in which:

- figure 1 is a diagram of a radio station according to the invention having a transmitting-receiving unit;

- figure 2 is a diagram of a radio station according to the invention having two antennas and one transmitting-receiving unit;

- figure 3 is a diagram of a variant embodiment of the station of figure 2;

- figure 4 is a diagram of a radio station according to the invention having one antenna and two transmitting-receiving units;

- figure 5 is a diagram of a radio station according to the invention having two antennas and two transmitting-receiving units;

- figure 6 is a diagram of a radio station according to the invention having two antennas and four transmitting-receiving units.

With reference to all of figures 1 to 6, the radio stations according to the invention described

here by way of example comprise either one antenna 1, or two antennas 1 and 2. Each antenna consists, for example, of two coplanar dipoles P1, P2 oriented perpendicularly to each other. By way of example, the dipole P1 may be placed horizontally and the dipole P2 vertically.

Each antenna 1, 2 is associated with a respective hybrid polarizing coupler 3_1, 3_2. Each of these couplers 3_1, 3_2 has two inputs A1, A2 and B1, B2 and two outputs, one, C1, C2 driving the dipole P1 of its associated antenna 1, 2, the other D1, D2 driving the dipole P2 of its associated antenna 1, 2.

Each polarizing coupler 3_1, 3_2 is chosen so that it produces two quadrature radio signals on its two outputs C1 and D1, C2 and D2. To this end, hybrid couplers, called "branch line" couplers, are used, as in patent application WO 97/37440, to which reference can be made.

The components delivered by the outputs Ci and Di of the coupler 3_i are thus still in quadrature one with respect to the other, such that when they drive the dipoles P1, P2 respectively of the associated antenna, the latter generates two orthogonal electric field components forming a circularly polarized wave. The left or right direction of the circular polarization depends on the polarization of the inputs Ai, Bi of the coupler from which the transmitted signal comes. Consider, for example, the case where a signal driving the input Ai of the coupler 3_i generates a left circularly polarized (LCP) wave, while a signal driving the other input B_i of the coupler 3_i generates a right circularly polarized (RCP) wave.

In the exemplary embodiment shown in figure 1, where the radio station comprises one antenna 1 associated with a hybrid polarizing coupler 3_1, the polarizing coupler 3_1 has its input A1 connected, via a duplexer 4_1, to a radio signal source or transmitter T1 forming part of a transmitting-receiving unit TR1, and

its input B1 connected to an input F1 of a receiver R1 forming part of said transmitting-receiving unit.

With the aim of providing circular polarization diversity processing, the duplexer 4_1 supplies a second radio signal to another input E1 of the radio signal receiver R1. The duplexer 4_1, associated with the polarizing coupler 3_1, separates the transmitting and receiving paths.

This arrangement of the duplexer has the advantage, compared to the arrangement which is adopted in the radio stations of the type described in WO 97/37440, of being able to house the transmitting-receiving unit, together with the duplexer 4_1, in the main housing 6 of the radio station, which is shown in dotted lines in figure 1, the antenna 1 and the hybrid coupler 3_1 then being outside this housing. Consequently, the station installer will have much more freedom with regard to the design and choice of antennas. He will also be able to choose to integrate the duplexer into a microwave circuit providing other functions, such as filtering, so as to limit the costs of the radio stage.

In the exemplary embodiment shown in figure 2, the radio station comprises another antenna 2 which is associated in a similar manner with another hybrid polarizing coupler 3_2. The antennas 1 and 2 are placed so as to radiate toward the same sector of space.

In the layout of figure 2, the polarizing coupler 3_1 still has its input A1 connected, this time directly, to the radio signal source T1, and its input B1 connected to the input E1 of the receiver R1. As for the polarizing coupler 3_2, it has its input A2 connected by a coaxial cable to the input F1 of the receiver R1. Its other input B2 is connected to a resistor 10 for impedance matching.

The presence of the two antennas 1 and 2 in the radio station makes it possible to combine the advantages of spatial diversity and of circularly polarized diversity in the two input signals of the

receiver R1. This is due to the fact that the radio signals supplied to the inputs E1, F1 of the receiver R1 come from non-homologous inputs B1, A2 of the polarizing couplers.

In the variant of figure 3, the signals processed by the receiver R1 come from homologous inputs B1, B2 of the two couplers such that the diversity processing applied by the receiver R1 only gives spatial diversity, possibly associated with a gain in directivity.

The layout of figure 2 or 3 is advantageous in the sense that a duplexer no longer has to be provided to separate the transmitting and receiving paths. However, depending on the performance of the coupler used and on the standing wave ratio of the antenna in the circular polarization direction used for the transmission, filters (not shown), which are smaller and less expensive than duplexers, will possibly be provided upstream of the inputs E1 and F1 of the receiver R1, in order to remove the components coupling with the powerful transmission signal.

In the embodiment shown in figure 4, the radio station comprises a single antenna 1 associated with a polarizing coupler 3_1, and two transmitting-receiving units TR1, TR2, with a radio signal source T1, T2 and a diversity receiver R1, R2. The advantages outlined above can be fully obtained for the two transmitting-receiving units TR1, TR2.

In the layout shown, the inputs A1 and B1 of the polarizing coupler 3_1 are connected to the radio signal sources T1, T2, respectively, via a corresponding duplexer 4_1, 4_2. In addition, the input A1 of the polarizing coupler 3_1 is connected by a coaxial cable, via the duplexer 4_1, to an input I1 of a division module 5_1 which is included in the main housing 6 of the radio station and which is, for example, a coupler of the "Wilkinson" type, while the other input B1 of the coupler 3_1 is in addition connected by a coaxial cable, via the duplexer 4_2, to an input I2 of a division module

5_2, which is identical to the module 5_1. The division module 5_1 has two outputs G1, H1, one of which, G1, is connected to the input E2 of the receiver R2 and the other of which, H1, is connected to the input E1 of the receiver R1. The division module 5_2 also has two outputs G2, H2, one of which, G2, is connected to the input F2 of the receiver R2 and the other of which, H2, is connected to the input F1 of the receiver R1. This embodiment has the additional advantage of obtaining, with only one antenna 1, a gain in polarization diversity for each of the two receivers R1 and R2. In this case too, the duplexers can be housed in the main housing 6 of the station.

The exemplary embodiment shown in figure 5 combines the advantages of the embodiments shown respectively in figures 2 and 4. In this example, there are two antennas but no duplexers. The inputs A1 and B2 of the polarizing couplers 3_1 and 3_2 are connected directly to the radio signal sources T1 and T2. As for the other inputs B1 and A2 of these polarizing couplers, they are connected to division modules 5_1 and 5_2, respectively, which are for example of the same type as those mentioned above. The division module 5_1 has its outputs G1, H1 connected to the input E1 of the receiver R1 and to the input E2 of the receiver R2, respectively, while the division module 5_2 has its outputs G2, H2 connected to the input F1 of the receiver R1 and to the input F2 of the receiver R2, respectively. This embodiment thus gives a gain in spatial and polarizing diversity for each of the two receivers R1 and R2 if the two antennas radiate toward the same sector of space.

An arrangement such as that of figure 5 can also be used in cells of elongate shape such as those which go along railroads or main highways. In this case, the two antennas 1, 2 are placed head to tail, so as to radiate toward two diametrally opposite sectors.

It should also be noted that, in this example, the station installer has the freedom of choosing the

option of a gain in receiving directivity instead of a gain in polarizing diversity. For this, it will be enough, for example, for him to reverse the connection of the coaxial cable which connects the input A2 of the coupler 3_2 to the output I2 of the division module 5_2 with the connection of the coaxial cable which connects the input B2 of the polarizing coupler 3_2 to the radio signal source T2.

In the example shown in figure 6, the radio station comprises two antennas 1, 2 associated respectively with two polarizing couplers 3_1 and 3_2, two duplexers 4_1 and 4_2, four transmitting-receiving units TR1, TR2, TR3 and TR4 and two division modules $5'_1$ and $5'_2$. The division modules $5'_1$ and $5'_2$ have a structure similar to that of the division modules 5_1 and 5_2 mentioned above, with the one difference that they have four outputs G'1, H'2, J'1, K'1 and G'2, H'2, J'2, K'2, respectively, instead of two outputs. Each one may, for example, consist of three "Wilkinson" couplers arranged in two steps. The inputs A1, B1 of the polarizing coupler 3_1 are connected to the radio signal sources T1, T2, respectively, while the inputs A2, B2 of the polarizing coupler 3_2 are connected to the radio signal sources T3, T4, respectively. The duplexer 4_1 is connected between the input A1 of the polarizing coupler 3_1, the radio signal source T1 and the input I'1 of the division module $5'_1$, while the duplexer 4_2 is connected between the input B2 of the polarizing coupler 3_2, the radio signal source T4 and the input I'2 of the division module $5'_2$. The four outputs G'1, H'1, J'1, K'1 of the division module $5'_1$ are connected respectively to the inputs E4 of the receiver R4, E3 of the receiver R3, E2 of the receiver R2 and F1 of the receiver R1, while the four outputs G'2, H'2, J'2, K'2 of the division module $5'_2$ are connected respectively to the inputs E1 of the receiver R1, F2 of the receiver R2, F3 of the receiver R3 and F4 of the receiver R4. It is thus possible with this embodiment to increase even further the gain in polarizing diversity for the four

receivers R1, R2, R3 and R4 compared to how it was in the embodiment shown in figure 5. It is also possible to envisage, in a similar way to that described above, obtaining a gain in directivity for this embodiment, by differently connecting the coaxial cables which connect the polarizing couplers 3_1, 3_2 to the radio signal sources T1, T3 and T3, T4, respectively.

It goes without saying that the embodiments which have been described hereinabove have been given by way of purely indicative and nonlimiting example and that numerous modifications may be easily made by the person skilled in the art without in any way departing from the scope of the invention.

Thus, the person skilled in the art could adopt antennas whose geometry differs from that shown for the antennas 1 and 2, provided that the latter make it possible to generate two orthogonal electric field components in response to two quadrature radio signals.

Moreover, he could use various known types of polarizing couplers.

CLAIMS

1. Radio station, comprising several antennas (1, 2) associated with hybrid polarizing couplers (3_1, 3_2), respectively, each polarizing coupler having at least one input (A1 or B1, A2 or B2) connected to radio signal processing means comprising at least one receiver (R1) and two outputs (C1 and D1, C2 and D2) connected to the antenna which is associated therewith such that when said outputs deliver two quadrature radio signals, respectively, in response to a transmission signal received on one of the two inputs of the polarizing coupler, the antenna which is associated therewith generates two orthogonal electric field components forming a circularly polarized wave, in which the receiver is arranged so as to combine several input radio signals obtained from respective inputs of the hybrid polarizing couplers and in which the antennas (1, 2) are placed so as to radiate toward diametrically opposite sectors.

2. Radio station according to claim 1, in which at least one of the hybrid polarizing couplers (3_1, 3_2) has two inputs (A1, B1), from which two input radio signals supplied to the receiver (R1) are respectively obtained and in which the receiver is arranged so as to provide diversity processing based on said input radio signals.

3. Radio station according to claim 1 or 2, comprising two receivers (R1, R2) each receiving two input radio signals respectively, a first division means (5_1) connected between an input (A1 or B1) of one of the hybrid polarizing couplers and first respective inputs (E1, E2) of the two receivers, and a second division means (5_2) connected between an input (A2 or B2) of another hybrid polarizing coupler (3_2) and second respective inputs (F1, F2) of the two receivers.

4. Radio station according to claim 3, comprising two other receivers (R3, R4) each receiving two input radio signals respectively, one of these two signals being supplied by the first division means (5_1) and the

other of these two signals being supplied by the second division means (5_2).

5. Radio station according to any one of claims 1 to 4, comprising at least one radio signal source (T1) delivering said transmission signal to an input (A1 or B1) of a polarizing coupler (3_1).

6. Radio station according to claim 5, comprising at least one duplexer (4_1) connected between the input (A1 or B1) of the polarizing coupler (3_1) to which said transmission signal is delivered, an input (E1 or F1) of the receiver (R1) and the radio signal source (T1).

7. Radio station according to claim 6, in which the radio processing means and the duplexer (4_1) are housed in a main housing of the radio station, each antenna (1, 2) and each hybrid polarizing coupler (3_1, 3_2) being outside said main housing.

8. Radio station according to claim 7, characterized in that the duplexer (4_1) is included in a radio circuit also including part of the radio processing means.

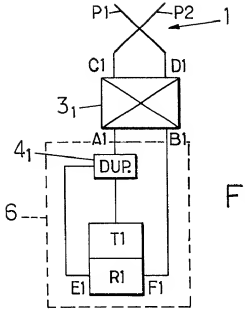


FIG.1.

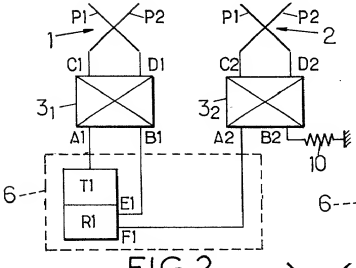


FIG.2.

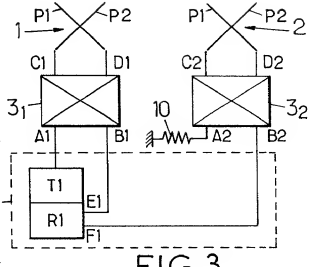


FIG.3.

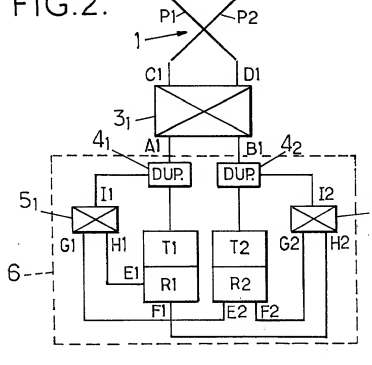
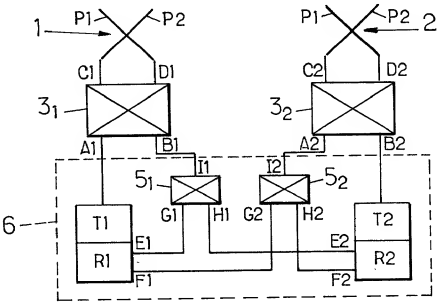


FIG.4.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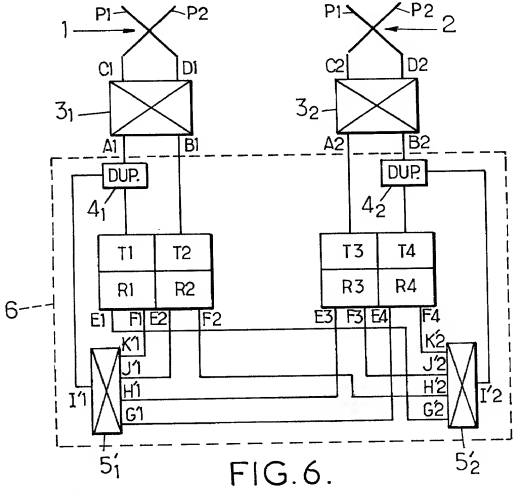
C1
D1
3 1
A1
B1
5 1
I1
G1
H1
6
T1
R1
E1
F1
P1
P2
2
C2
D2
3 2
A2
B2
I2
5 2
G2
H2
T2
R2
E2
F2

FIG.5.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P2
C1
D1
3 1
A1
B1
DUP.
4 1
T1
T2
R1
R2
6
E1
F1
E2
F2
K'1
J'1
H'1
G'1
I'1
5'1
P1
P2
2
C2
D2
3 2
A2
B2
DUP.
4 2
T3
T4
R3
R4
E3
F3
E4
F4
K'2
J'2
H'2
G'2
I'2
5'2

FIG.6.

Docket No.

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

RADIO STATION WITH CIRCULARLY POLARIZED ANTENNA

the specification of which

(check one)

☒ is attached hereto.

☐ was filed on _____ as United States Application No. or PCT International Application Number _____

and was amended on _____

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Not Claimed
99 01921	FRANCE	17/02/1999	☐
(Number)	(Country)	(Day/Month/Year Filed)	
			☐
(Number)	(Country)	(Day/Month/Year Filed)	
			☐
(Number)	(Country)	(Day/Month/Year Filed)	

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112. I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

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